



Exploring the Potential for an Air Emissions Trading System for Alberta: Lessons Learned from Existing Trading Regimes

Final Report

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1. INTRODUCTION

The Government of Alberta is in the process of developing a strategy to enhance Alberta's air emissions management framework. The goal is to achieve better environmental results in a manner that would be cost-effective for both the public and private sectors. Toward this end, Alberta is exploring the potential for implementing an Alberta-based air pollutant and greenhouse gas (GHG) emissions trading system and is evaluating alternative approaches to setting air emissions limits for the Province as a whole as well as for potential participants in the trading regime. This study was commissioned to inform Alberta's decision-making process by evaluating relevant multi-pollutant trading regimes currently operating in other jurisdictions and developing a set of lessons learned that could be applicable to the Alberta setting.

1.1. Overview and Methodology

Several steps were involved in determining which set of programs to include in the study. First, a research effort was undertaken to identify and assemble information on potentially relevant existing trading regimes (see Appendix 1). Second, in conjunction with Alberta Environment, a set of selection criteria relating to the scope, coverage, and longevity of the programs, was developed. Specifically, it was decided that out of the set of nine programs identified in step one, those that would provide the most applicable lesson for Alberta would:

- Be regional, as opposed to national, in scope;
- Provide coverage of multiple pollutants; and
- Have been in existence long enough for meaningful results to be evident.

Finally, each of the nine candidate programs was evaluated on the basis of the selection criteria. Three existing emissions trading programs—the Regional Clean Air Incentives Market (RECLAIM) program operating in the South Coast Air Quality Management District in Southern California, the Emissions Banking and Trading Program in Texas, and the Emission Averaging and Emission Reduction Credit Trading Program in Michigan—were found to most nearly satisfy all of the basic requirements.

Following selection of the programs for inclusion in the study, a more intensive research effort was initiated to fully characterize the programs and to develop insights that could be instructive for Alberta. Findings for each of the three programs are discussed in detail below. Major topic areas include:

- An overview of the program's objectives and major features;
- An assessment of the environmental effects deriving from the program;

- Data on the regulatory agency's organizational and capacity requirements;
- Cost information for both the regulatory agency and program participants; and
- Additional insights each of the programs offered in the form of advice to a jurisdiction that is considering or is in the process of designing a multi-pollutant emissions trading system.

Much of the information included below was available through publicly accessible sources (see the bibliography). However, certain program attributes of interest to Alberta Environment—e.g., program development costs, staffing requirements for the regulatory agency, and costs to participants—could not be gleaned using literature search results. To obtain this additional information, ICF developed a questionnaire to which program specialists working for the regulatory agencies that oversee the RECLAIM, Texas, and Michigan programs responded. The questionnaire is included below in Appendix 2.

One attribute of all of these programs that is of particular note is that none contain provisions for trade in carbon emissions. The pollutants currently regulated and traded in these jurisdictions are those that affect regional air quality and subsequently, human health. To date there are no regional programs that include carbon in multi-pollutant emissions trading. On one level, including carbon in a multi-pollutant emissions reduction regulation can be beneficial. The emissions that are being regulated or those that might become regulated in the future influence certain decisions, such as purchases of alternative emissions control equipment or the choice of fuel type. However, caution must be exercised when contemplating the inclusion of carbon in a regional multi-pollutant trading system. The impacts of carbon emissions are global in nature and the costs of abatement vary substantially across regions of the world. From an economic perspective, carbon trading that is limited to a regional market can result in overly high costs for carbon instruments.

1.2. Organization of the report

The rest of this report is organized as follows. Section 2 provides the foundation for the report by focusing on the nature of emissions trading and environmental protection. The section begins with background material on the basic types of emissions trading systems including a brief introduction to the different types of traded instruments and the various design features—such as banking, netting, and opt-in provisions—that might be included. In addition, Section 2 provides an overview of two existing national greenhouse gas (GHG) systems—one in Denmark and the other in the United Kingdom—and a summary of design features and benefits associated with multi-pollutant trading systems. The final subsection provides a discussion of the basic requirements for a successful trading system.

The three trading systems selected for review in this study are described in detail in Section 3. Although both the Texas and Michigan programs have been in operation almost as long as RECLAIM, neither state has devoted as many resources to documenting and evaluating their programs as has the South Coast Air Management District in Southern California.

As a result, far more extensive information is available on RECLAIM than on either of the other two programs assessed here and that is reflected in the length of the subsection on RECLAIM relative to the other two programs.

Section 4 highlights the lessons learned from each of the three trading systems as to assuring environmental benefits, establishing robust market conditions, and designing workable rules and procedures for monitoring, verification, and record keeping.

2. EMISSIONS TRADING AND ENVIRONMENTAL PROTECTION

This section provides an overview of the rationale for and approaches to employing an emissions trading regime as part of an overall strategy for environmental protection.

2.1. Background

Economists have long advocated the incorporation of market-based mechanisms, such as emissions trading, into environmental policy regimes. Under traditional approaches to environmental protection, regulators tend to have too little information available to them to determine the most cost-effective means of achieving their environmental objectives. At the same time, those in the best position to recognize and implement cost-effective pollution controls—i.e., facility owners and managers—have an incentive to undertake as little control as possible and thus, tend to overstate their actual control costs.

As with other market-based mechanisms, emissions trading can provide a solution to the information and incentive problems inherent in command-and-control regimes. In particular, when regulated entities are allowed to buy and sell emission instruments, incentives are created for facilities with relatively low-cost control options to reduce their emissions by more than necessary and sell emission instruments to entities facing relatively higher control costs. Provided that the incremental costs of emissions control vary sufficiently across regulated entities, trading can result in a more cost-effective level of control than would be the case under more traditional regulatory approaches. In other words, by allowing emissions trading, the same level of environmental protection can be achieved at a lower overall cost. On the other hand, if all covered entities have very similar cost structures, then the control cost savings associated with emissions trading could be smaller than the administrative and transactions costs incurred in operating and participating in a trading regime. If this is the case, then emissions trading might not produce an outcome that is superior to a more traditional regulatory approach.

2.1.1. Basic Types of Trading Systems

Emissions trading systems take one of three basic forms: pure allowance systems, under which all participating entities are allocated allowances that place an absolute limit on the mass of emissions they can discharge; pure credit systems, under which participating entities are subject to either absolute or relative emission targets; and hybrid systems that combine elements of both pure allowance systems and pure credit systems. Each of these three forms is described in more detail below.

Pure Allowance Systems: Under this type of trading system, each regulated entity is assigned an absolute emissions ceiling specified as a given amount of the pollutant that can be released within a compliance period. The regulatory authority creates and distributes allowances (or emission permits) to each covered entity in an amount that is equal to the entity's emissions ceiling. Each allowance gives the owner the "right" to emit one unit (e.g., one tonne) of the pollutant. The entities are free to buy or sell allowances but, at the end of the compliance period, each participant is required to surrender to the regulatory body enough allowances to cover all of its actual emissions during the compliance period.

Pure Credit Systems: Regulated entities that are covered by a pure credit system are given emission targets that are specified as either an absolute target, which is a specific ceiling on emissions for a given compliance period, or a relative target, which is an emissions "rate" often expressed as emissions per unit of output (e.g., 0.6 tonnes of CO₂/kWh). Participating entities that can demonstrate that they have reduced their emissions by more than the required amount, are eligible to sell emission reduction credits equaling the difference between their target level of emissions and their actual emissions. Entities that are unable to reduce their emissions in a more cost-effective manner can then purchase credits and use them to comply with their regulatory requirements.

Hybrid Trading Systems: Elements of pure allowance systems and pure credit systems are often combined, creating hybrid systems. Under a hybrid system, some participating entities, typically those with the highest emission levels, are assigned an absolute emissions target and allocated an equivalent number of marketable emission allowances. In addition, these entities are allowed to purchase emission reduction credits generated by participants that are not subject to absolute emission targets. There are several ways that such credits can be generated. Non-covered entities could reduce emissions (relative to a baseline) and then sell credits, covered entities could invest in off-site emission abatement or sequestration projects, or a third party could invest in emission reduction or sequestration projects and sell credits to covered entities.

Each type of system has its advantages and disadvantages. Since the emission reduction options under pure allowance systems are limited to those technologies and/or practices applicable to the set of entities that are directly covered by the trading system, these regimes tend to offer the least amount of flexibility of the three basic forms. On the other hand, by placing an absolute limit on the total mass of pollutants that participants can emit during the specified compliance period, pure allowance systems tend to be more effective in assuring that the desired environmental results are realized.

Because they typically allow for more widespread participation, both the pure credit system and the hybrid trading system increase flexibility, and probably reduce overall compliance costs, relative to a pure allowance system. However, neither of these systems is assured of producing the targeted level of overall emission reductions that is being sought by the regulatory authority. In addition, because of the need to verify and certify that emission reductions have taken place, the administrative and transactions costs associated with either a pure credit or hybrid system tend to be significantly higher than they are under a pure allowance regime.

2.1.2. Traded Instruments

There are two fundamental types of emission instruments that are traded by participants in an emissions trading system. The use of these basic instruments varies somewhat depending upon the type of trading program. Under a pure allowance system, which is often referred to as cap-and-trade, and for a subset of the participants in a hybrid system, the traded instruments are emission allowances or permits that are issued by the regulatory body. The number of allowances issued equals the emissions ceiling that is set by the regulatory authority. Allowances are allocated among participants with fixed emission ceilings either through "grandfathering," which entails distributing the permits free of charge on the basis of past emission, output or throughput levels, or via auctioning the permits off to the highest bidder. Ownership of these instruments changes as trades take place. Each permit typically carries a unique registration number that is used to track the permit if and when it changes hands.

The second basic type of instrument is generally referred to as some form of emission reduction credit (ERC). Under some trading regimes, a distinction is made between ERCs and DERCs (discrete emission reduction credits). Specifically, ERCs are usually measured as continual reductions that occur across multiple compliance periods while DERCs are reductions that are applicable to a single compliance period. To obtain either ERCs or DERCs, an entity must usually apply to have its emission reductions reviewed or certified by the relevant regulatory body. There are specific criteria for certification under different programs. The following criteria are common to several emission trading programs:

- Real – Reductions must be based on a specific abatement action.
- Surplus – The reductions must be in excess of any regulatory requirement.
- Quantifiable – There must be a reliable way to measure and calculate the reduction.
- Permanent – the reductions cannot be reversible.
- Enforceable – The entity must commit to permanently operating at the new strategic emission level.

A summary of the three types of traded instruments providing definitions, and information on lifetime, bankability, and the units of measurement is laid out in the table below.

Traded Instrument	Allowances	Emission reduction credits (ERCs)	Discrete emission reduction credits (DERCs)
Definition	Government issued permits allocated to participants as a limited right to pollute. Sources are allowed to emit only up to the allowances they own.	Perpetual voluntary emissions reductions below a permitted emission level	Voluntary emissions reductions below a permitted emission level
Lifetime	Allocated annually Quantified retrospectively	Permanent / long term Quantified prospectively	Discrete amount of time Quantified retrospectively
Bankability	Depends on individual program	Depends on individual program	Bankable by definition
Units of measurement	Stream of emissions (e.g., tonnes / year) or Emissions rate (e.g., kg of emissions / unit of output)	Stream of emissions (e.g., tonnes / year) or Emissions rate (e.g., kg of emissions / unit of output)	Mass (e.g., tonnes) of pollutant reduced

2.1.3. Trading System Features

Within each of the three basic types of systems a variety of features can be included to further improve the flexibility that covered entities have in meeting their targets and/or to augment system coverage by encouraging emission reduction activities by entities that are not assigned targets.

Banking: Rather than requiring participants to trade or use emission instruments in the current compliance period, programs with banking provisions allow participants covered by a trading regime to hold tradable emission instruments, for various time periods, and use or trade them in later years. In most trading programs, limits are placed on the length of time that allowances and other traded instruments can be banked.

Borrowing: Under borrowing provisions, participants in a trading program are able to use allowances that are scheduled to be issued in later periods for compliance in the current period. In principle, borrowing should only be allowed if the entity is able to clearly demonstrate that it will have the capability of repaying the borrowed instruments by sufficiently reducing its future emissions. Most trading programs do not allow borrowing.

Opt-in provisions: In certain trading regimes, opportunities are created for entities without assigned targets to elect to join the trading program. These entities are then treated as any other regulated participant—i.e., they are assigned an emissions cap, receive allowances, can generate emission reductions credits, and otherwise act as any other regulated entity covered by the trading system.

Entities electing to opt-in become permanent participants in the regulated segment of the trading program, which means they cannot later decide to withdraw from the regime.

Bubbles: A bubble policy permits two or more emission points to be treated as if they are a single source. Bubbles can be extended to include not only emission points within the same plant, but emission points in plants owned by different firms.

Netting: Netting allows sources undergoing modification or expansion to avoid onerous new source review requirements providing the changes do not result in any significant net increase in plant-wide emissions. Emission reduction credits earned elsewhere by the source (plant) can be used to offset increases expected from the expanded or modified portions of a facility.

2.2. GHG Trading Systems

To get a head start on satisfying their commitments under the terms of the Kyoto Protocol, several countries are already experimenting with the development of GHG trading systems. Two of these programs are briefly highlighted below.

2.2.1. Denmark

Denmark has established a pilot CO₂ trading system for its electricity sector that is set to run between 2001 and 2003. Trading takes place in a cap-and-trade system designed and operated by the Danish Energy Agency. The system covers nine large emitters in the electricity-generating sector. These companies represent more than 90% of the total CO₂ emissions from that sector, and approximately 30% of total Danish GHG emissions. The electricity sector is the only GHG emitting sector that is not subject to the carbon taxes and energy efficiency measures that are widely applied throughout Denmark's economy. GHG emissions from the electricity sector were capped at 22 million tonnes of CO₂ in 2001. This cap is scheduled to decline by one million tonnes each year until 2003.

Permits were allocated to firms according to their actual GHG emission levels during the period between 1994 and 1998. New producers in the Danish electricity market will be allocated allowances relative to their estimated CO₂ emissions. A penalty of DKK 40 (~US \$7) is applied for every tonne of CO₂ that is emitted beyond a given firm's individual cap. The size of the fine is intended to be low,¹ to ensure that the competitiveness of firms is not affected significantly when the price of electricity exports is high.²

2.2.2. The United Kingdom

The UK GHG emissions trading scheme came into effect in April 2002. The program is a key element in the UK government's strategy to ensure compliance with its Kyoto Protocol Commitment of reducing greenhouse gas emissions to 12.5% of the 1990 levels by 2008-2012. Participation in the program is voluntary and is overseen by an emission trading authority.

¹ In comparison to the long-term international market price for carbon, the Danish fine is indeed low. However, the fine is higher than current prices for carbon. For example, through the Dutch ERUPT system, carbon credits are purchased between 1-5 US\$ per tonne of carbon dioxide.

² National Round Table on the Environment and the Economy, June 2002. <http://www.nrtee-trnee.ca/EmissionsTrading/en.htm>

As a means to encourage participation, the UK government relied heavily on financial incentives such as subsidies for emission reduction activities and reductions in tax rates applicable under the UK's Climate Change Levy (CCL).³ In the UK Emissions Trading System, a descending clock auction was selected because it was deemed to be the simplest for bidders. There is typically more than one round of bidding. To start each round, the auctioneer announces a price range. Each bidder states the quantity of emission reductions that they are willing to make at prices within that price range. If the quantity of reductions multiplied by the price exceeds the budget for that period that triggers a new round. Each round has a successively lower price range and bidders must either maintain or lower their quantities at lower prices. The auction ends when a price multiplied by the total quantity bid is equal to or less than the budget. Participants that are unable to comply with their targets, have the option of either purchasing permits or paying the taxes they would have been charged under the CCL.

The rules of the UK program allow firms to participate in trading activities in several different ways.

- Firms not subject to the CCL are given a financial incentive to reduce emissions.
- Firms that have prior CCL agreements have the right to trade permits in order to meet targets but are not directly given permits through financial incentives.
- Organizations that do not carry out emissions reduction targets or project activities may register for an account and participate in buying and selling permits.⁴

2.3. Multi-pollutant Trading Systems (MPTS)

The Canadian Council of Ministers of the Environment (CCME) is currently coordinating the development of multi-pollutant emissions reduction strategies (MERS) for six industrial sectors: pulp and paper, lumber and allied wood products, electric power, iron and steel, base metals smelting, as well as concrete batch mix and asphalt mix plants. The MERS process addresses the following key pollutants: NO_x, SO₂, PM, and Hg. The first MERS is proposed to be established for the electrical power sector. The MERS process is a primary driver for potential implementations of provincial multi-pollutant emissions trading systems as a means to meet future sectoral emissions limits. The benefits and design features of an MPTS are described below.

2.3.1. Benefits of MPTS

A variety of benefits can derive from developing and implementing a multiple pollutant emission trading system. In addition to improving air quality and providing numerous human health benefits, a multiple pollutant emissions reduction trading system will tend to:

³ The levy is a single-stage tax charged at the time of industrial and commercial supply rather than the time of consumption. Taxable commodities are electricity, natural gas as supplied by a gas utility, petroleum and hydrocarbon gas in a liquid state, coal and lignite, coke, and semi-coke of coal or lignite, and petroleum coke. The quantity and type of fuel supplied determines the amount taxed.

⁴ National Round Table on the Environment and the Economy, June 2002. <http://www.nrtee-trnee.ca/EmissionsTrading/en.htm>

- Provide incentives for the creation of new markets in emissions control technology;
- Reduce opportunities to shift to production practices that increase emissions of an uncontrolled pollutant in response to controls on another;
- Provide covered entities with greater opportunities to reduce their overall costs of compliance with multiple pollutant requirements when their control costs for one pollutant are relatively low while their costs of controlling a second pollutant are relatively high. A firm facing low cost control options for a given pollutant could over comply with that regulatory requirement, sell its excess reductions, and use the proceeds to partially off-set the costs of controlling some other emissions.
- Potentially offer some scale economies for the regulatory authority by encompassing multiple pollutants within a single regulatory scheme.

2.3.2. Design features of MPTS

Key considerations and design elements for a multi-pollutant trading system might include:

- Reporting and trading for a range of emission types-i.e., emissions that are regulated and those that might be regulated in the future;
- Specifying the approach to estimating and measuring emission reductions, including appropriate baselines;
- Providing for verification of emission reduction actions;
- Clearly specifying ownership of emission reductions so that double counting of emission reductions is avoided;
- Providing practical and workable methodologies and guidance for its current and future users through its simplicity, ease of administration, and low administration costs;
- Avoiding duplication of effort by allowing any reported reduction that is required under an existing mandatory program to automatically be transferred to the appropriate reporting system; and
- Establishing methods for monitoring significant increases and decreases in each type of emission captured and tracked by the reporting system. For example, where an action results in the reduction of one pollutant while at the same time increasing another, this should be captured and tracked by the reporting system.⁵

2.4. Basic Requirements for a Successful Trading System

Properly designed, emissions trading systems can reduce compliance costs, stimulate technological development, and provide the necessary incentives for achieving environmental objectives.

⁵ Leonardo Academy, 1998. *A Multiple Pollutant Emission Reduction Reporting System*. Version 1.2, September 15, 1998.

A number of basic requirements must be satisfied for any emissions trading program to provide these results. This section briefly highlights the major factors that must be appropriately addressed in system design.

2.4.1. Environmental Integrity

In general, the environmental results of an emissions trading system are ultimately determined by the underlying regulatory requirements. However, there are circumstances under which the interaction of a trading system and an existing regulatory framework could work to the detriment of the environment. These occur when the trading system allows for inter-gas trading, sanctions cross-season or cross-region trading, or induces activity shifting (leakage).

Inter-gas trading: Allowing tradable emissions instruments denominated in one pollutant to be used to partially satisfy the regulatory requirements applicable to another pollutant could interfere with the attainment of environmental objectives. This is particularly problematic in cases where the scientific evidence supporting the relationship between two pollutants is unclear or when the relationship changes with changes in other conditions. For example, ground level ozone formation depends upon the chemical interaction between NO_x and VOCs in the presence of sunlight but the relative importance of the two pollutants can vary depending on circumstances. Unrestricted inter-gas trading between NO_x and VOCs could result in a reduction in one pollutant in situations where reducing the other is more important.

Cross-season or Cross-region Trading: The impacts of some air pollutants are primarily seasonal and/or regional. NO_x , SO_x , and VOCs are all cases in point. If emission instruments in any one of these pollutants can be readily traded on a one-for-one basis regardless of the season or region in which permits or emission reduction credits were created, trading could contribute to the formation of "hot spots"—i.e., areas where the concentration of a given pollutant is unacceptably high.

Activity Shifting: Leakages associated with activity shifting is another potential source of conflict between a trading system and the underlying regulations that were established to achieve a particular environmental objective. One set of issues surrounds projects undertaken to generate emission reduction credits. Awarding emission reduction credits for forest conservation activities that can be used as offsets against carbon or other GHG emission reduction requirements is a practice that is particularly vulnerable to this type of problem. Preserving forests on one plot of land might mean that harvesting activities simply shift to another adjacent or near-by area. Activity shifting can also include the contracting out/out-sourcing of a company's activities. For example, if a company oxidizes asphalt as part of its manufacturing process and then decides to out-source this activity to another company, the emissions have not been reduced, but simply shifted.

2.4.2. Robust Competition Among Participants for Traded Instruments

Trading systems only function well if there is a sufficient number of participants to ensure that no one party or coalition of parties has the ability to significantly influence the price at which emission instruments are traded.

Insufficient competition within a trading system can result in two forms of market power, both leading to the manipulation of prices of the traded instruments. In the first case, a single firm or combination of firms covered by the underlying regulatory regime could attempt to manipulate the price of traded instruments for their own financial gain—e.g., if the firm or firms are net sellers of permits, they might withhold instruments from the market in an effort to obtain higher returns for the instruments they do sell. In the second case, a single firm or coalition of firms might attempt to use their dominant position in the emissions trading market to provide them with a competitive advantage in their product market. For example, a dominant firm might purchase and hoard emission allowances in an effort to deny its competitors the access to emission instruments they need in order to produce their products. Creative system design features, such as opt-in programs and offset options can, to some extent be used to discourage both of these types of manipulation.

Another, and somewhat more difficult problem to handle, can arise if there are too few entities covered by the program. A trading system must provide sufficient coverage to ensure that there are enough buyers and sellers to produce a market wherein prices are relatively stable. In thinly traded markets, price volatility can be a serious problem—discouraging participants from relying on purchases of tradable instruments for any portion of their compliance needs. However, empirical evidence and model simulations suggest that at as few as 8-10 active participants might be all that are needed to ensure reasonably stable markets.⁶

2.4.3. Monitoring, Verification, and Record Keeping

The success or failure of any regulatory system tends to rest on the quality of enforcement of its requirements. In turn, the ability to provide effective enforcement is, in large measure, a function of the monitoring and verification procedures established by the program. As a rule, air emission regulations are not easily enforced. Many of the pollutants are not visible and can only be detected via the use of relatively expensive monitoring technologies or estimated based on activity levels and emission factors that relate activity levels to emission levels. Nevertheless, several methods can be used to determine whether or not individual facilities are in compliance with program requirements. These include: self-certification by covered entities; on-site inspections; and direct monitoring of pollutant flows.

Self Certification: One method of detecting compliance entails requiring that covered entities routinely prepare and submit reports on their adherence to the regulatory requirements. This approach is most likely to be successful in cases where pollutant flows are closely tied to specific processes or fuel use. For example, in the case of carbon dioxide emissions due to the combustion of fossil fuels, enough is currently known about the relationship between the carbon content of traditional fuels (such as oil, natural gas, and coal) and carbon dioxide emissions for regulators to have a relatively high degree of confidence in an entity's inventory of emissions from these sources. Providing that fuel consumption data can be confirmed, self-certification of compliance could provide a sufficient basis for determining compliance with carbon emission limitations.

⁶ Tietenberg, T. H., *Emissions Trading: an exercise in reforming pollution policy*. Resources for the Future, Inc., Washington, DC, 1995.

However, because participants have an incentive to under-report their actual emissions, in most settings self-certification is unlikely to be a highly reliable tool for enforcement purposes. Moreover, self-certification is especially problematic in an emissions trading setting. Potential buyers of emissions instruments are reluctant to risk purchasing allowances and credits unless they have some third party assurance that the instruments are indeed surplus.

On-site Inspections: Direct inspections of emission sites are likely to be preferable to self-certification in many cases. Such inspections are useful in determining whether measurement and control equipment is functioning properly and/or whether the covered facility is recording and reporting their actual emission levels. If the universe of covered facilities is relatively small or if it is possible to conduct random spot checks of a subset of the facilities, on-site inspections can provide a more reliable enforcement tool. Conversely, if the number of facilities is large or if the geographic dispersion of covered facilities makes unannounced inspections difficult, on-site inspections can become highly impractical for the regulatory agency.

Direct Monitoring of Pollutant Flows: For most sources, a more reliable means of determining compliance entails the use of direct monitoring technologies. Continuous Emissions Monitoring Systems (CEMS) for example, are widely used to determine the mass of emissions of several species of gases from large stationary sources—such as electric power generators. CEMS, however, are expensive to purchase and install and the systems typically require specially trained personnel to ensure that they are properly operated and maintained. Similar systems are not available for small stationary sources nor can they be used to measure emissions from mobile sources.

In addition to the general set of issues that need to be addressed to ensure compliance under any regulatory system, allowing entities to use emission reduction credits to fully or partially satisfy their emission targets presents another layer of compliance and enforcement issues that must be addressed. Specifically, the validity of the reductions must be assessed and a determination made concerning whether they are real, surplus, quantifiable, permanent, and enforceable (see section 2.1.2 above). Because ERCs can frequently be generated by a very diverse set of sources, the resources needed to determine their quality, and thus suitability for use in satisfying emission limitation, requirements can be quite large.

Finally, to track progress and help facilitate the settling up process at the end of each compliance period, detailed records of all transactions need to be maintained. Of particular note are any changes in the ownership of allowances and purchases and sales of emission reduction credit instruments. Participants should be required to demonstrate clear legal entitlement to any and all emission instruments they surrender to satisfy their commitments. Without precise record keeping that tracks the transfer of each instrument, the regulatory agency could be placed in the very difficult position of having to resolve disputes between two or more participants who are claiming the right to use the same allowance or emission reduction credit to satisfy their requirements for compliance.

3. MULTI-POLLUTANT TRADING IN PRACTICE

This section summarizes the programs, resource requirements, and results for three existing trading systems that might serve as models for the development of various elements of a 4P trading system for Alberta. The programs discussed below include California's Regional Clean Air Incentives Market (RECLAIM) program, the Texas Emissions Banking and Trading Program, and the Michigan Emissions Averaging and Emission Reduction Credit Trading Program.

3.1. RECLAIM

The Regional Clean Air Incentives Market (RECLAIM) program is a market-based emission reduction program designed by the South Coast Air Quality Management District (AQMD) to control ozone and particulate matter concentrations in the South Coast Air Basin (Basin).⁷ RECLAIM, which was authorized on October 15, 1993 and began operation on January 1, 1994, is the oldest of the local emissions trading systems, and has a number of special features that could be of interest to Alberta.

This section provides a summary of the main features and objectives of the RECLAIM program as well as more detailed information on regulatory and administrative aspects of the program and its costs and results.

3.1.1. Overview of Program and Objectives

RECLAIM was created to provide incremental improvements in the Basin's air quality and to reduce the cost of achieving those improvements. Because continued emission reductions were needed to meet federal clean air standards, the allowance allocation schedule, facility coverage, and other features of RECLAIM were designed to meet or exceed the emission reductions planned under the region's existing regulatory framework. The program was created with three key features:

- An allowance based cap-and-trade system covering large stationary source emitters of SO_x and NO_x;
- An opt-in program that allows certain non-covered participants to enter the program voluntarily; and
- An emissions reduction credit program covering mobile or area sources.⁸

Cap-and-Trade Feature: The central feature of RECLAIM is an allowance system that covers large, stationary source emitters of SO_x and NO_x.⁹ There are separate markets in RECLAIM for each category of pollutant. Sources receive an annual emissions cap and comparable allocation that allows them to emit specified amounts of each pollutant.

⁷ AQMD covers the four-county region of Los Angeles and Orange counties and Riverside and San Bernardino counties west of the mountains. The area encompasses nearly 11,000 square miles and holds about half the population of the State of California.

⁸ Mobile sources are moving objects that release pollution, including road vehicles (such as cars, trucks, and buses) and non-road vehicles (such as trains, planes, and lawn mowers). "Area" sources consist of smaller-size facilities that release lesser quantities of toxic pollutants into the air. Area sources are defined as sources that emit less than 10 tons per year of a single air toxic, or less than 25 tons per year of a combination of air toxics. Though emissions from individual area sources are often relatively small, collectively their emissions can be of concern - particularly where large numbers of sources are located in heavily populated areas.

⁹ Stationary sources include power plants, incinerators, factories, and commercial facilities.

The traded instruments under this feature, which are denominated in pounds of emissions, are known formally as RECLAIM Trading Credits, or RTCs. Any covered entity that receives RTCs in excess of their actual emissions is allowed to sell the excess; conversely, any facilities receiving an allocation that is insufficient to cover their actual emissions must purchase RTCs from other facilities. In order to provide continuous improvements in air quality, the number of allowances allocated to each facility declines throughout the period from 1994 through 2003 and then remains constant through 2010.

An important feature of the initial allocation process under RECLAIM is that it was *not* based on actual emissions. Rather it was based on historical production levels and past levels of equipment use. This approach avoided penalizing companies that had modernized their pollution control systems.

Opt-In Program: The second key feature of RECLAIM is an opt-in program that is linked to the allowance program. This feature allows sources that are not mandatory participants to enter the program voluntarily. Facilities that elect to opt-in—i.e., voluntarily join the program—are provided with an emissions allocation based on the same rules determining the allocation of covered facilities in that year. The facility entering can then reduce its emissions and sell any excess allowances. Once facilities opt-in to the program, they are not allowed to opt-out.

Emission Reductions Credit Program: This feature of RECLAIM is designed to provide a means of allowing trading with smaller emission sources that were not covered by the cap-and-trade feature. Under this program, marketable emission reduction credits (ERCs) based on mobile or area sources can be generated by undertaking specified activities, such as the purchase and disposal of high polluting equipment. Almost since the program's inception, RECLAIM facilities have had the opportunity to create credits by retiring older, high emission vehicles. Over time, AQMD also developed credit programs for other mobile sources, such as lawn and garden equipment; recently, a pilot program was introduced that provides for similar options with regard to marine vessels and truck and trailer refrigeration units.

Credits are good for only one year and can be traded only with respect to the year for which they have application. Banking of credits was not permitted since the object was to show improvement every year. Emitters that shut down still retain (and can sell) their credits. New emitters that expand or start up must buy credits from those who hold them. While there has been a large enough market for credits in California to allow entry, not allowing banking of emission instruments is a matter that Alberta might want to consider carefully. Relying strictly on current period instruments could contribute to a temporary shortage of credits on the market that would make it prohibitively expensive for new entrants. Reserving some permits for auction to new entrants and making provisions for some banking of emission instruments could help avoid this problem and maintain sufficient liquidity in the system to keep it from becoming a barrier to entry.

3.1.2. Developing the Program

Beginning in 1990, development of the RECLAIM program spanned a period of approximately three years. The program development process consisted of four phases: (1) public workshops; (2) concept development; (3) a feasibility study; and (4) rule development.

In each phase, public participation in the process was extensive and encouraged through meetings and workshops. In addition, public hearings were held to receive testimony from a wide range of industrial and environmental groups.

An Advisory Committee and a Steering Committee (a subset of the Advisory Committee) were formed to assist in designing RECLAIM. The Advisory Committee identified and assisted in analyzing key design issues, evaluated state and Federal regulatory constraints to determine whether the program would be in compliance with Federal and state clean air standards, and identified areas of concern. The Steering Committee assisted in designing the proposed system. During the rule development phase, the Advisory and the Steering Committees were expanded and nine working groups were formed to provide focused input on the development of various elements of the program.¹⁰

In order to understand the market operation and resolve complexities involved in establishing a trading system, AQMD consulted with a modeling team that was able to simulate the results of alternative design features. The exercises suggested that a system of annual allowances expiring on the same date might induce allowance price volatility and increase compliance costs.¹¹ To address this, developers introduced two staggered compliance periods for allowances and a reconciliation period at the end of each compliance period.

Because RECLAIM was designed to replace portions of, and otherwise supplement, existing regulations, the allowance system was easier to implement than if regulations had not already been in place. A considerable body of information already existed on the location and characteristics of emission sources, on the effectiveness and cost of available control technologies, on baseline emissions, and on monitoring techniques. Moreover, stationary sources included in the program were already covered by emission regulations. Thus, the owners and operators of these sources were largely familiar with government regulation and the concept of emissions control.

3.1.3. Gases and Sources

The allowance program covers all major stationary sources in the Basin with NO_x and SO_x emissions greater than 4 tons per year. The sources included in the allowance system represent a significant portion of the region's stationary sources of NO_x and SO_x emissions.¹² Although, the remaining sources—which include area sources such as dry cleaners and restaurants, and mobile sources—are not mandatory participants in the allowance system, in some cases, they are subject to current regulations or could be included in future regulations, as needed.

Excluding some sources from the allowance program did not significantly limit the program's ability to achieve reductions comparable to those anticipated under the regulatory regime and it helped achieve two other goals.

¹⁰ AQMD, 1993

¹¹ Ibid.

¹² As of October 1993, permitted sources (i.e., those covered by command-and-control prior to RECLAIM) represented 17 percent of the total NO_x emissions and 31 percent of the total SO_x emissions in the South Coast Air Quality District.

In particular, it limited participation to facilities that were believed to be able to afford the expensive emissions monitoring equipment that program designers had determined to be critical to effective enforcement and reporting (see discussion of Continuous Emission Monitors (CEMs) below). In addition, restricting the program to large sources also limited the administrative burden of the program.¹³

New Sources: Under RECLAIM, new or relocated facilities are required to purchase enough RTCs to fully offset all of their emissions during each year of operation. In addition, they are subject to applicable Federal and state air quality regulations governing new sources. Industry analysts have criticized RECLAIM's approach to new sources, arguing that the policy is onerous for new and modified sources, and that it discourages new business in the area because of the "difficulty of financing a future emission credit stream of uncertain availability and cost."¹⁴

Inter-gas Trading: RECLAIM does not allow inter-gas trading. Since the Basin's air quality problems (O_3 and PM_{10}) resulting from the pollutants (NO_x and SO_x) were largely distinct, separate allocations and markets for the two "families" of pollutants were established. In addition, target air quality levels in RECLAIM were driven by externally set standards (primarily Federal Clean Air Act standards). Thus, it was both possible and desirable to divide the markets for NO_x and SO_x and to impose separate caps on total allowances for each family of gases.

Cross-Region Trading: Although allowances in RECLAIM can generally be freely traded among facilities, trading between upwind and downwind sources is restricted because of the Los Angeles air basin's geography and the concentration of air quality problems in inland areas. Upwind sources, therefore, cannot purchase downwind credits beyond their initial allocations without triggering new source review (NSR) proceedings.

Banking: The designers of the RECLAIM program chose not to allow banking. Rather, permits have a lifetime of one year—i.e., each allowance can be used to cover emissions in a specified 12-month period.¹⁵ Although a longer lifetime for permits and/or banking has the advantage of allowing companies the flexibility to move emissions across time, it creates uncertainty about what actual emissions and air quality conditions will be at any point in time. The goal of regulators was to control emissions contributing to smog, and to achieve steady progress toward Federal clean air standards; if a large number of banked allowances were used in any given year, this goal might not be met. In addition, not allowing banking can contribute to a liquid allowance market and discourage hoarding of allowances for market manipulation.

¹³ At the end of compliance year 2000, there was a net total of 335 facilities. All 335 facilities were included in the NO_x market, and 37 were included in the SO_x market (AQMD, 2002). During the 2000 compliance year, 22 facilities shut down, 2 of these facilities cited RECLAIM as a contributing factor to ceasing operation.

¹⁴ Jonker and Quinn, 1995

¹⁵ The issues of permit lifetime and banking are closely related. A critical decision in defining the terms of a permit is choosing the time period for the emissions covered by the allowance—whether the permit allows emissions only during a particular time frame, or whether it has a start (but perhaps no end) date, thereby allowing the facility to "bank" and use the permit any time after the start date. Banking across permit periods can also be formally established for permits that have fixed start and end dates.

3.1.4. Data Requirements

Monitoring and Measuring: Each facility covered by the RECLAIM program is required to install and operate a CEM system, which allows the facility to monitor and record its NO_x and SO_x emissions. All large NO_x and SO_x emissions sources are required to report their daily emissions. At larger companies, RECLAIM uses computer networks that link remote sensors directly to monitors at AQMD headquarters. If a facility cannot transmit its data because of the failure of the remote terminals, the facility must estimate emissions using "interim period calculations" based on past emissions data and an estimation methodology developed by AQMD. Facilities that have not installed CEM systems must report their emissions using "missing data routines," also developed by AQMD, which are calculations that assume that the maximum possible level of pollutants have been emitted.

The selection of CEMS technology for RECLAIM was controversial. Smaller RECLAIM facilities in particular were concerned about the expense of CEM systems. AQMD, however, decided to require CEMS for RECLAIM for several reasons. First, because CEMS could be used by all the facilities that AQMD intended to include in RECLAIM, AQMD anticipated that across the board use of CEMS would foster a sense of equity. Second, CEMS are highly accurate, and their accuracy contributed to public confidence that RECLAIM would achieve its air quality goals. Third, the automated reporting associated with CEMS reduced AQMD's administrative burdens.

Record keeping and Reporting: In the RECLAIM program, facilities must submit periodic emission reports and self-certify their quarterly statements. AQMD may conduct a facility audit where analysis of a facility's emissions data indicates that an audit is needed. Facility audits include inspecting both the emissions records and the facility. Audits are intended to ensure that reported emission levels and emissions reductions can be demonstrated, that facility operators are following required procedures, and that all equipment and operations at the facility are included in the facility permit.

Allowance trades and prices are tracked in an official allowance listing that is maintained by AQMD staff. This listing contains an allocation account and an allowance certificate account for each registered holder, and is used by AQMD to determine compliance with RECLAIM emission ceilings. RECLAIM requires the seller and buyer of allowances to jointly file a form registering the allowance transfers. The form must identify both trading parties, the amount and the type of emissions, the trading zone from which the instrument originated, the transaction date, and the price per pound of emissions. It must also describe how the allowances were generated and their intended use. This information is used to verify emissions reductions and to update the allowance listing.

3.1.5. Compliance and Enforcement

RECLAIM incorporates a variety of administrative remedies to ensure that if a facility exceeds its allowance allocation and does not purchase sufficient additional allowances, adequate compensating emission reductions are achieved in subsequent years. The Executive Officer of RECLAIM has statutory authority for implementing these administrative remedies.

To ensure a strong field presence and proper enforcement of the RECLAIM regulations, AQMD developed inspector training programs, compliance guidelines, and rule interpretation documents. AQMD conducts field compliance inspections and source tests to verify compliance with program requirements. RECLAIM facilities that do not hold enough allowances to meet their NO_x or SO_x emissions in any year are required to make up the difference the following year, and may be subject to monetary penalties. In addition, AQMD has the authority to revise facility permits to include conditions deemed appropriate to prevent future violations. In extreme cases of noncompliance, AQMD has the authority to effectively shut down the facility by revoking its air permits.

3.1.6. Regulatory Agency Organization and Capacity Requirements

AQMD is organized into three branches. The first is a 12 member Governing Board, which is the decision making body that engages in rule-making and creates plans such as the regional Air Quality Management Plan (AQMP) that guides many of AQMD's activities. The Governing Board is comprised of nine elected officials and three that are appointed to the board by state officials. The second branch of AQMD is the Hearing Board, a quasi-judicial panel that is authorized to provide relief from AQMD regulations under certain circumstances.¹⁶ Hearing Board members are appointed but act independently of the Governing Board.

The third branch is the management and staff, which report directly to the Governing Board. This branch is responsible for developing rules and rule amendments, ensuring compliance by regulated facilities, planning programs, intergovernmental review, public outreach and assistance, and prosecuting violations. In the early 1990s, prior to RECLAIM, AQMD employed over 1150 persons and had an annual operating budget in excess of \$113 million.¹⁷ Since that time, AQMD has streamlined many of its operations and reduced the cost of many of its programs. For the 2002-03 fiscal year budget, AQMD¹⁸ adopted a \$99.2 million budget, reflecting a \$3.8 million decrease in expenditures from the 2001-02 budget primarily due to a proposed \$2.1 million cutback in state funding. The budget includes funding for 785 positions, which reflects a planned reduction of 29 positions by attrition if state funds are cut. Compared to a decade ago, AQMD has 33 percent fewer staff and the budget has decreased by 26 percent (the 2002-03 fiscal budget was adjusted for inflation between 1992 and 2002)¹⁹.

Resources specifically devoted to the RECLAIM program as it is currently operated consist of six staff members who cover all administrative needs. Additional staff members who devote their time to RECLAIM and other AQMD needs include four engineers, one supervisor, one manager, two clerical staff and two staff from the information management department who handle electronic reporting.

¹⁶ For example, the Hearing Board addresses petitions by companies covered by AQMD regulations for variances and other relief from specific actions.

¹⁷ This is the actual budget for the 91-92 fiscal year and has not been inflation adjusted.

¹⁸ Draft Fiscal Year 2001-02 Budget and Work Program, of the South Coast Air Quality Management District, April 10, 2001. For additional information see <http://www.aqmd.gov/fin/draftbudget.html>

¹⁹ \$99.2 million in 2002 = \$83.9 million in 1992

A significant part of AQMD's revenue comes from fees that businesses must pay if they release large amounts of pollution. Thus, the biggest polluters pay the most toward funding the air pollution control effort. Also, businesses must pay annual fees for their permits. AQMD uses a system of evaluation fees, annual operating fees, emission fees, Hearing Board fees, contracts, penalties/settlements, and investments that generate approximately 76% of its revenues. The remaining 24% of its revenues come from an Environmental Protection Agency grant, the California Air Resources Board subvention, and California Clean Air Act Motor Vehicle fees.²⁰

3.1.7. Environmental Results

Analyses of the environmental benefits of the RECLAIM program relative to the previous command-and-control approach to regulating emissions in the four-county region indicate that RECLAIM has achieved the same emission reductions goals as planned under the regulatory system and has done so at a pace, at least in the early years, that exceeds the goals set under the prior regime. These results are largely attributed to the approach AQMD used in allocating allowances.

Emissions control under RECLAIM represented a fundamental departure from the way emissions were regulated under the prior regulatory approach. In particular, RECLAIM limits the total mass of NO_x and SO_x that is released into the atmosphere while the previous approach limited the concentration of the two pollutants in the exhaust vented into the atmosphere or the mass of emissions per unit of fuel or output. RECLAIM thus establishes an upper limit on emissions that is independent of future production activities. Conversely, emissions under the prior regulatory approach could have varied depending on such factors as future economic conditions, production levels, and how production was distributed across the various emission sources.

As noted above, the methodology developed for allocating RTCs to facilities covered under RECLAIM was designed to bring RECLAIM mass emissions to the same level as would have obtained by continuing with the command-and-control approach. Equally important, is the fact that while the old system aimed to reach this endpoint in 2010, RECLAIM was designed to achieve the same results by 2003.

In the early years of the RECLAIM program, emission estimates are thought to have exceeded actual emissions due to the use of emission factors and RECLAIM's requirement that covered entities report "worst-case" scenarios if they did not have continuous emissions monitoring systems in place.²¹ For recent years, the program's rigorous monitoring, reporting, and record keeping requirements have lead to a high degree of confidence in reported emission levels for both gases.

²⁰ Because motor vehicles account for more than half of the Basin's pollution problem, beginning in 1991, a surcharge was added to the area's vehicle registration fees to help fund air pollution control efforts. This surcharge consists of a \$4 per vehicle state fee and an additional \$1 per vehicle district-wide fee. The \$1 fee and 30% of the \$4 fee from vehicles registered in our four counties goes to AQMD to be used for mobile source programs such as those promoting ridesharing and developing clean fuels. Forty percent of the \$4 fee goes directly to cities located in the four county area and is used to fund air quality improvements involving mobile sources. The remainder is distributed through an independent panel as grants for programs intended to reduce vehicle emissions. For additional general information on AQMD, see <http://www.aqmd.gov/aqmd/intraaqmd.html#funding>

²¹ AQMD Office of Engineering and Compliance, 2000. "Review of RECLAIM Findings", October 20, 2000.

In a recent study comparing results between RECLAIM and the prior command-and-control regime AQMD staff concluded that RECLAIM has produced emission reduction results that are fully equivalent to reductions that might have been realized under the prior regulatory framework, but at a significantly lower costs.²²

3.1.8. Costs to Participants

In December of 1999, AQMD released the first in-depth audit of the RECLAIM program.²³ Chapter 7—Socio-Economic Impacts—addresses various aspects of the private sector costs of the RECLAIM program. In particular, the analysis examines costs associated with process changes implemented by entities for compliance purposes and record keeping and monitoring costs. In 1993, projected average annual costs for all participants in RECLAIM over the period from 1994 through 1997 were expected to equal \$164.2 million (in 1995 dollars). Of this amount, emission control equipment installation was expected to consume \$102.0 million while record keeping and monitoring would account for the remainder. Results of the audit indicated that actual costs for record keeping and monitoring, including the installation of CEMs, was approximately \$13.3 million. Moreover, the audit found that annual spending on NO_x control equipment through 2003 would be approximately \$14.9 million. Insufficient data prevented AQMD from developing any similar calculations for annual spending on SO_x reductions.

3.1.9. Additional Insights from Program Offices

In response to ICF's inquiries regarding specific advice that RECLAIM staff might offer to another jurisdiction that is considering implementing an emissions trading program, staff members provided input in three areas: early problems the program experienced with its requirement that participants install and operate CEMS; initial staffing constraints that the program did not fully anticipate; and recent problems associated with the California energy crisis.

During the initial stages of the program, a variety of difficulties arose with the monitoring system and support to the participating facilities. CEMS, the monitoring system required for RECLAIM participants, had been in use prior to the implementation of the program, but only in few facilities. Upon program initiation, a large number of covered sources were required to implement the system. Initially, AQMD had expected that all of the necessary systems could be put in place within one year from the inception of the RECLAIM program. However, many of the entities that were required to install new systems encountered a series of serious problems including difficulties with installation, certification, operating software, and reporting requirements.

²² These results have been criticized by two environmental NGOs—the Natural Resources Defense Council (NRDC) and the Coalition of Clean Air (CCA)—who argued that AQMD used an inappropriate baseline to calculate the benefits that would have occurred had the previous framework been continued. In particular, NRDC and CCA believed that the starting point for evaluating RECLAIM benefits should be AQMD's 1993 emissions inventory and not the 1991 inventory that the AQMD study actually used. Based on the NRDC/CCA methodology, projected command-and-control emissions are indicated to be significantly below RECLAIM emissions and RTC supply. However, AQMD has countered that the NRDC/CCA approach is biased by the economic recession that occurred in the early 1990s and that RECLAIM has in fact realized its goals as these were established relative to the region's 1991 Air Quality Management Plan (AQMP).

²³ Although limited interim audits are performed on an annual basis, AQMD is only required to produce an in-depth assessment of the RECLAIM program every three years. The next scheduled release date for an in-depth audit is late 2002.

In total, it took roughly two and a half years to fully resolve all the problems participants experienced with the new systems. One of the principal reasons for all of the problems was that there are only a limited number of manufacturers and vendors. Consequently when the RECLAIM program initiated coverage of such a large number of sources, the capacity of the manufacturers and vendors to supply, install, and service all of the CEMS required was severely strained.

Staffing problems also proved problematic for the RECLAIM during the design and implementation stages as well as early on in its operation. AQMD seriously underestimated the level of support that entities would require to participate in the trading regime. Initially the existing staff was used more intensively—i.e., they found it necessary to put in additional hours work. Once the workload was assessed and more realistic projections made, additional staff were hired and trained.

The recent California energy crisis pointed out two additional factors that should be taken into account in designing a new trading system. First, it became apparent that rules governing long range planning by participants in the RECLAIM system needed to be implemented. Participating sources are now required to submit long-term plans that specify how they expect to obtain credits in future compliance periods. In addition, RECLAIM staff noted that a regulatory department contemplating an emission trading program should consider ways of coping with liquidity problems that might arise in the event of an energy crisis. Uncertainty in the energy markets contributed to a low volume of trade in the RECLAIM market and created problems with volatility.

3.2. Texas Emissions Banking and Trading Program

In 1993, the Texas Natural Resource Conservation Commission (TNRCC) implemented the Emission Banking Rule, which initiated the Texas Emissions Banking and Trading Program. Subsequent revisions in 1994, 1997, and most recently in 2000, created additional programs have been introduced to allow participants greater flexibility in complying with program requirements. This section provides a summary of the main features and objectives of the Texas trading system and provides information on regulatory and administrative aspects of the program as well as its costs and environmental results.

3.2.1. Overview of Program and Objectives

The Texas Emissions Banking and Trading Program offers a market based framework for trade in reductions of criteria pollutants from stationary, area, and mobile sources. The program was developed to provide emission sources flexibility in complying with the Texas Clean Air Act while simultaneously imposing additional emissions reductions with each trade. The trading system is comprised of three programs:

- The Emission Credit Banking and Trading program is an open market trading program developed to address growth in non-attainment areas.

Implemented in 1993, this program addresses NO_x and VOC emissions and introduced trade in Emission Reduction Credits (ERCs). On December 23, 1997, a revised "Trading Rule" expanded the use of ERCs to also comply with EPA's Reasonably Available Control Technology (RACT) requirements.²⁴

- The 1997 amendments introduced tradable instruments, called Discrete Emission Reduction Credits (DERCs). DERCs can be generated for reductions of oxide of nitrogen (NO_x), volatile organic compounds (VOCs), carbon monoxide (CO), sulphur dioxide (SO₂), and particulate matter (PM₁₀).
- In 2002, the TNRCC launched the Mass Emissions Cap and Trade Program covering NO_x emissions from large area sources in the Houston-Galveston non-attainment area. The cap-and-trade program runs in conjunction with the two open market programs, which together make up the first state run "hybrid system".

ERC Feature: In the Texas Emissions Banking and Trading Program, an ERC is a perpetual reduction in NO_x or VOC emissions in non-attainment areas.²⁵ All emissions reductions must first be reviewed and approved by the TNRCC before being certified. ERCs are generated from actual NO_x or VOCs emission reductions, as measured from a source's baseline emission levels. Baseline emissions are calculated using a source's actual emissions for any two-year period in the ten years preceding the emission reduction, with the proviso that the baseline must not exceed the 1990 or any subsequent emissions inventory. ERCs, which are denominated in tons per year, are calculated by subtracting a source's actual emissions limit from the emission source's baseline emissions. Emission reductions can be generated by a permanent shutdown of a unit, a permanent change in a manufacturing process, installation of pollution control equipment, permanent production curtailment, or pollution prevention projects. Emission reductions are voluntary but must satisfy the five criteria for ERC creditability—i.e., they must be enforceable, permanent, quantifiable, real, and surplus both at the time of certification and at the time of use.

To register for ERCs, an application must be submitted to the TNRCC by the source within 180 days of the implementation of the emission reduction strategy. Applications must cover each pollutant at each emission point.²⁶ Applications are reviewed by the TNRCC and ERC certificates are issued for creditable reductions.

As of January 2, 2001, ERCs are valid for trade within five years of the reduction. ERCs that were applied for or certified prior to January 2, 2001 are available for use for ten years from the date of reduction. ERCs must be used in the same non-attainment area as they were generated unless specific conditions are met-e.g. ERCs can be used in another non-attainment area if the non-attainment area where the reductions will be used has an equal or lower non-attainment status than the non-attainment area where the reductions were generated.

²⁴ TNRCC Rules - 30 TAC Chapters 115 and 117

²⁵ TNRCC Rules - Chapter 101, Subchapter H, Rules 101.300-101.304

²⁶ For a list of all the required information see TNRCC Rules - Chapter 101, Subchapter H, Rules 101.303.

ERCs have typically been used as alternative means of compliance under NO_x RACT and VOC RACT, as offsets for new sources or a major modification to an existing source. However, they can also be used for netting (provided that the generator is the user).

DERC Feature: A DERC represents a discrete reduction in NO_x, VOC, SO₂, CO, or PM₁₀ emissions.²⁷ Like ERCs, prior to certification, the emissions reductions on which DERCs are based must first be reviewed and approved by the TNRCC.

Stationary, mobile, and area sources can earn DERCs by reducing actual emissions below baseline levels. Baseline emissions are calculated using the source's actual emissions for any 24-month period during the 120 months preceding the emission reduction. This encourages facilities to participate in the program. The emissions baseline must not exceed the 1990 or any subsequent emissions inventory. Unlike ERCs, DERCs do not carry units of time—i.e., they are denominated in tons rather than tons per year. Thus, whereas ERCs denote continuous reductions, DERCs are based strictly on past reductions and are quantified only after the reductions have been realized.

DERCs are generated by similar means as ERCs but with one important exception. Emission reductions attributed to a decrease in production, whether or not permanent, cannot be used to create DERCs. However, DERCs can be generated by a permanent shutdown of a facility, installation of pollution control equipment, changes in manufacturing processes, or the implementation of pollution prevention projects. Emission reductions are voluntary, and to be creditable, must be real, quantifiable, and surplus at the time of generation. Because they have no expiration date (see below), firms might prefer DERCs to ERCs if they anticipate higher future prices for emission instruments.

To register for DERCs, an application must be submitted to the TNRCC by the source within 90 days after the emission reduction strategy has been completed.²⁸ Applications must cover each pollutant at each emission point.²⁹ Applications are reviewed by the TNRCC and DERC certificates are issued for creditable reductions.

Once qualifying emission reductions have been certified, the resulting DERCs are eligible for trade and have no expiration date. However, certain other restrictions do apply. NO_x and VOC DERCs that are generated in an attainment area may only be used in attainment areas. DERCs that are generated in non-attainment areas may only be used in the same non-attainment area or in an attainment area. SO₂, CO, and PM₁₀ DERCs must be used in the same metropolitan statistical area in which the reduction was generated. Another important stipulation for DERC use is timing. Areas that have less than a twelve-month ozone season are subject to restricted conditions; NO_x and VOC DERCs that are generated in a non-ozone season cannot be used to satisfy emission limitation requirements during an ozone season.

²⁷ TNRCC Rules - Chapter 101, Subchapter H, Rules 101.370-101.374

²⁸ Or 90 days after the first 12 months of the reduction strategy if the reduction strategy lasts more than 12 months.

²⁹ For a list of all the required information see TNRCC Rules - Chapter 101, Subchapter H, Rules 101.373.

DERCs can be used as offsets for a new source or major modification to an existing source, for exceedances of permit requirements,³⁰ as alternative means of compliance under RACT requirements, and for compliance with requirements under the NO_x cap-and-trade system (this program is presented in the section below). However, DERCs cannot be used for netting nor can they be used to comply with federal emission standards or permitting requirements.³¹

When a purchase of ten or more DERCs is made, sources are required to obtain an additional 5% of the amount of credits that are needed. This feature was included strictly as a measure to ensure that users purchase a sufficient number of DERCs to cover emission overages.

ERC and DERC Registry: The TNRCC's registry posts all generators and users of ERCs and DERCs. All credits available are assigned a serial number and are listed on the registry. Listings of all of the credits that are available and that have been used are continuously updated. Each of the non-attainment areas has a separate listing, while all attainment areas are combined into a single listing.

Inter-Gas Trading of ERCs and DERCs: In general, reductions of one pollutant cannot be used to satisfy the emission reduction requirements for another pollutant. There are two exceptions to this rule. The first is when the TNRCC and U.S. EPA authorize the substitution of one pollutant for another based on urban airshed modeling. A second exception occurs when emission reductions are generated outside of the United States by facilities that are located within 100 kilometers of the Texas-Mexico border. The TNRCC approves substitution in this case if it:

- Results in greater overall air quality and health benefits;
- Is from a reduction of a criteria pollutant from a non-attainment area; and
- If all supporting documentation for calculations, modeling, and additional information is submitted to the TNRCC.

Cap-and-Trade Feature: On January 1, 2002 the NO_x Mass Emission Cap and Trade (MECT) program came into effect as a response to the December 2000 adoption of the State Implementation Plan (SIP) for the Houston/Galveston non-attainment area (HGNA). The SIP called for an overall 90% reduction in NO_x from stationary sources by November 2007. Adopted as a means for NO_x compliance, the MECT program was designed to provide sources with additional flexibility in satisfying the new emission stipulations and to allow for economic growth in the region.

In order to determine applicable sources, all firms located within the HGNA were required to identify existing facilities that emit NO_x. Facilities having collective design capacities of greater than ten tons in any single year since 1997 are obliged to participate in the MECT program and must follow all the program regulations.

³⁰ In non-attainment areas, DERCs may be used to exceed permit allowables by a maximum of 25 tons for NO_x and 5 tons for VOC for up to 12 months of any 24 month period, as approved by the TNRCC. In attainment or non-classified areas, the exceedance is based on federal limits for up to 12 months for any 24 month period.

³¹ The use of DERCs to comply with federal rules would circumvent the intents of these requirements.